
Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy, Tennessee 37384-2000

June 7, 2005

U.S. Nuclear Regulatory Commission
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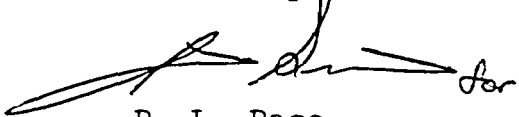
10 CFR 50.73

Gentlemen:

**TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT (SQN)
UNIT 1 - DOCKET NO. 50-327 - FACILITY OPERATING LICENSE
DPR-77 - LICENSEE EVENT REPORT (LER) 50-327/2005-001-00**

The enclosed LER provides details concerning a Unit 1 automatic reactor trip and an auxiliary feedwater engineered safety feature (ESF) actuation. The automatic reactor trip occurred as a result of the loss of turbine auto stop oil pressure. This event is being reported, in accordance with 10 CFR 50.73(a)(2)(IV)(A), as an event that resulted in an automatic actuation of the reactor protection system and auxiliary feedwater actuation.

Sincerely,



P. L. Pace
Manager, Site Licensing and
Industry Affairs

Enclosure

cc (Enclosure):

INPO Records Center
Institute of Nuclear Power Operations
700 Galleria Parkway, SE, Suite 100
Atlanta, Georgia 30339-5957

IE22

LICENSEE EVENT REPORT (LER)

(See reverse for required number of
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

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4. TITLE
Automatic Reactor Trip Following Loss of Turbine Auto Stop Oil (ASO) Pressure

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	09	2005	2005	- 001 -	00	06	7	2005	FACILITY NAME	05000
									FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE 1	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)									
	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)						
10. POWER LEVEL 100	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)						
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)						
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)						
	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)						
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)						
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)						
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER						
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A						

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME J. Bajraszewski, Licensing Engineer	TELEPHONE NUMBER (Include Area Code) 423-843-7749
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13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On April 9, 2005, at approximately 1111 Eastern daylight time, an automatic reactor trip occurred followed by a turbine trip. The reactor trip was initiated by low ASO pressure input to the reactor protection system. The unit was operating with no abnormal indications prior to the trip. The reduction in pressure was the result of the failure of a red rubber gasket installed between the turbine protective trip block and the turbine governor pedestal. A tear in the gasket allowed oil in the ASO supply port to bypass the trip block and bleed directly to the drain port. The root cause of the event is improper machining of the turbine front pedestal oil ports during original manufacturing by Westinghouse Electric Company. This resulted in oil port misalignment and oil seepage between the turbine protective trip block and the turbine governor pedestal. Because of oil port misalignment, sheet gasket material had been used in place of the originally designed O-rings to seal the mating surfaces. The gasket material was not fully compatible with turbine oil and design of the connection did not support use of sheet gasket material. To correct the condition, the trip block and governor pedestal were reassembled with O-rings at the oil ports and gasket sealant on the metal to metal surfaces. Follow-up inspection found the interface to be leak free.

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7. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

I. PLANT CONDITION(S)

Unit 1 was in Power Operation (Mode 1) at approximately 100 percent thermal power.

II. DESCRIPTION OF EVENT

A. Event:

On April 9, 2005, at approximately 1111 Eastern daylight time (EDT), an automatic reactor trip occurred followed by a turbine trip. The reactor trip was initiated by low auto stop oil (ASO) pressure [EIS Code TD] input to the reactor protection system [EIS Code JC]. The plant responded to the reactor and turbine trips as designed, including the automatic start of the auxiliary feedwater (AFW) system. The unit was operating with no abnormal indications prior to the trip.

B. Inoperable Structures, Components, or Systems that Contributed to the Event:

None.

C. Dates and Approximate Times of Major Occurrences:

April 1981	Unit 1 begins commercial operation.
September 1998	TVA requested and received vendor approval to allow the use of BUNA-N sheet gasket material in place of O-rings to resolve oil seepage at the turbine protective trip block to turbine governor pedestal interface.
April 2003	Verbal concurrence was obtained from the vendor field services representative to use red rubber sheet gasket material.
November 2004	A new red rubber sheet gasket material was installed during the Unit 1 Cycle 13 refueling outage.
April 9, 2005 at ~1111 EDT	Reactor and turbine trips as a result of low/loss of ASO pressure.

D. Other Systems or Secondary Functions Affected:

None.

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E. Method of Discovery:

The reactor trip was annunciated on the main control panel [EIS Code CBD].

F. Operator Actions:

Control room operators responded to the event in accordance with plant procedures. Following the automatic reactor and turbine trips, operators took actions necessary to stabilize the unit, and maintained the unit in Hot Standby, Mode 3.

G. Safety System Responses:

Main turbine ASO pressure is maintained by normally closed solenoid and mechanical dump valves. With no trip condition present, these valves block the ASO flow path to drain and maintain pressure on associated switches and devices keeping them in a "reset" state. If a trip condition is sensed, one or more of these valves open to depressurize the ASO system and initiates a turbine trip. ASO pressure on Unit 1 main turbine decreased to the point of initiating a reactor trip signal through switch inputs to the reactor protection system. The reactor trip initiated a turbine trip, as designed.

The plant responded to the reactor and turbine trips as designed and as described in the Final Safety Analysis Report (FSAR), including the automatic start of the AFW system. Reactor power remained within technical specifications (TSs) and FSAR analysis limits. Reactor coolant system (RCS) [EIS Code AB] pressure remained within TS limits and responded as expected for the event conditions. The pressurizer safety relief valves and power operated relief valves did not actuate. Operators reduced the flow of AFW following the reactor trip to mitigate a decrease in RCS average temperature. RCS temperature remained above 541 degrees Fahrenheit for the event. The rod position indication system [EIS Code BWR] showed the rods fully inserted.

III. CAUSE OF THE EVENT

A. Immediate Cause:

The immediate cause of the unit trip was loss of ASO pressure. The reactor trip was initiated by low ASO pressure input to the reactor protection system. ASO pressure loss occurred because of the failure of a red rubber gasket installed between the turbine protective trip block and the turbine governor pedestal.

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Failure of the gasket provided an oil flow path between the ASO supply and drain ports. Gasket failure is attributed to material incompatibility and misapplication of sheet gasket material. The red rubber gasket material was not fully compatible with turbine oil and design of the connection did not support use of sheet gasket material.

B. Root Cause:

The root cause of the event is improper machining of the turbine front pedestal oil ports during original manufacturing by Westinghouse Electric Company. This resulted in oil port misalignment and oil seepage between the turbine protective trip block and the turbine governor pedestal. Because of oil port misalignment, sheet gasket material had been used in place of the originally designed O-rings to seal the mating surfaces.

C. Contributing Factor:

Contributing to the event was the failure to understand the cause of oil seepage at the turbine protective trip block and the turbine governor pedestal connection. As a result, actions were taken to change from O-ring seals to sheet gasket material without full understanding of the connection design or the impact of material substitution.

In 1998, in an attempt to stop the oil seepage, TVA personnel requested and Siemens Westinghouse approved the use of sheet gasket material as a replacement for O-rings. Maintenance was concerned with the recommended BUNA-N gasket material because it tended to slip out of position and/or extrude under pressure during tightening. The protective trip block bolting pattern did not ensure sheet gasket material would maintain position. This was a concern because the space between the supply and drain oil ports was approximately 0.130 inch. In subsequent outages, Maintenance substituted the BUNA-N material with red rubber sheet gasket material. This change was performed with verbal concurrence of Siemens Westinghouse without performing a material compatibility evaluation. Red rubber was found not to be fully compatible with the turbine oil. Failure of 1/16-inch thick gasket material created sufficient area to allow oil to bypass the protective trip block and flow from the supply port directly to the drain port. This bypass flow resulted in the loss of ASO pressure and initiation of the reactor and turbine trips.

External oil seepage and bypass oil leakage can be minimized when O-rings are used. The protective trip block, designed to use O-ring seals, contains counter bores that retain the O-rings in position in a positive pressure application. With

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the flow ports in alignment, the full O-ring face is compressed and provides an effective seal. With the oil ports not fully aligned, the full O-ring face was not compressed resulting in oil seepage. Additionally, with metal to metal contact between the protective trip block and the turbine pedestal, there is insufficient cross sectional area to allow significant bypass oil flow in the event of O-ring failure. If a sheet gasket is in use and it fails, the thickness of the gasket allows a significantly larger amount of oil to flow directly to the drain and reduce ASO pressure. Therefore, the use of any gasket was an inappropriate action.

IV. ANALYSIS OF THE EVENT

This event is bounded by the analyzed turbine trip event in the FSAR, with plant safety systems operating as designed during and following the reactor trip.

Prior to the event, the plant was in Mode 1 with the following conditions: RCS pressure was approximately 2235 pounds per square inch (psig) with an average temperature near program value of 578.2 degrees F; pressurizer [EIS Code PZR] level was on program at approximately 60 percent; secondary side steam pressure was approximately 865 psig with normal main feedwater supply and nominal full power steam flow; and steam generator (SG) levels were at 44 percent narrow range (NR).

Following the automatic reactor trip, the RCS pressure decreased to 2022 psig as a result of RCS temperature decrease and coolant volume shrinkage. The loss of nuclear heat generation and the introduction of cold AFW resulted in a decrease in RCS temperature to 541°F. Main control room operators took action to minimize RCS cooldown by taking manual control of AFW. Pressurizer level decreased to 25 percent and stabilized near 30 percent following the trip. After the trip, steam pressure increased to approximately 985 psig when the turbine stop valves closed. The atmospheric relief valves (ARVs) [EIS Code RV] on SG Nos. 1, 3, and 4 opened as designed, the ARV on SG No. 2 opened below setpoint. The SGs' safety relief valves did not open. Steam dumps to the condenser [EIS Code COND] operated as designed and remained available. AFW system actuated as designed on the SG low-low level signal, recovering the SG water levels following the reactor trip.

V. ASSESSMENT OF SAFETY CONSEQUENCES

Based on the above "Analysis of The Event," this event did not adversely affect the health and safety of plant personnel or the general public.

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VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions:

The Unit 1 turbine protective trip block was reassembled using the original O-ring configuration with a light coating of gasket sealant on the metal to metal surfaces. The gasket sealant was applied to ensure leakage between the faces was minimized. A follow-up inspection found the interface to be leak free.

B. Corrective Actions to Prevent Recurrence:

Data was taken confirming misalignment of the oil ports on Unit 2. The misalignment was large enough to allow part of the O-ring to fall into the supply oil port in the pedestal. The Unit 2 protective trip block was machined to increase the O-ring counter bore such that a larger sized O-ring will fully seal the oil port.

At the next Unit 1 refueling outage, the Unit 1 trip protective block will be machined to assure proper O-ring mating surfaces by increasing the O-ring counter bore and installation of appropriately sized O-rings.

VII. ADDITIONAL INFORMATION

A. Failed Components:

Commercial grade red rubber sheet gasket material.

B. Previous LERs on Similar Events:

A review of previous reportable events for the past three years did not identify any previous similar events.

C. Additional Information:

Contributing factors discussed in this LER are being addressed within the Corrective Action Program under Problem Evaluation Report Number 80518.

D. Safety System Functional Failure:

This event did not result in a safety system functional failure in accordance with 10 CFR 50.73(a)(2)(v).

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E. Loss of Normal Heat Removal Consideration

This event did not result in a loss of normal heat removal.

VIII. COMMITMENTS

None.